Characteristics of a High Performance School

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A Professional Corporation
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Characteristics of a High Performance School

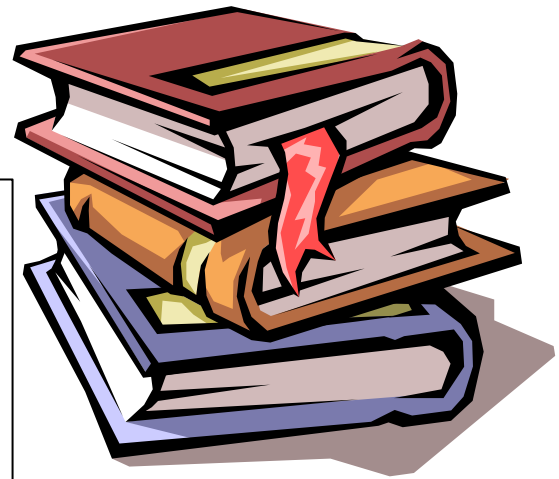
It's not magic…….

- Principles
- Importance
- Benefits
- Practical Applications

High Performance: Principles

- Holistic Design Approach
- Sustainable Site Design
- Water Efficiency
- Energy & Atmosphere Conservation
- Materials & Resource Conservation
- Indoor Environmental Quality
- Education/Community
- Commissioning

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN



But it requires study and work up front……..

High Performance Design *Principles*

Typical Linear Design Process

OWNER

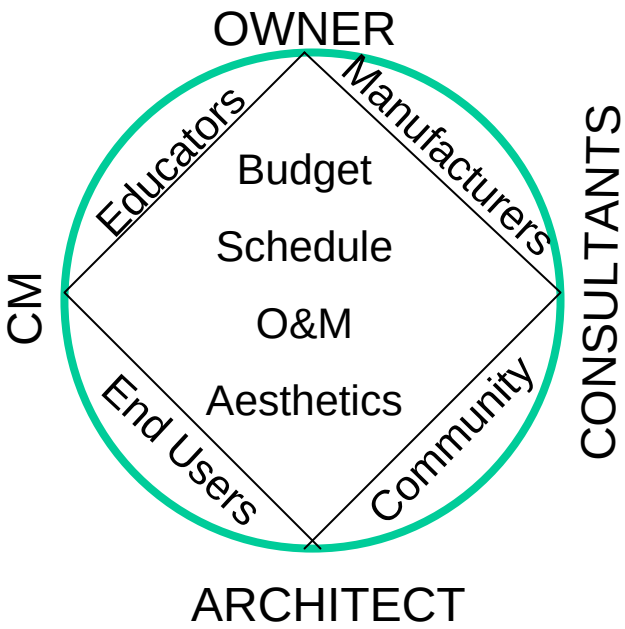
ARCHITECT

CONSULTANTS

CONSTRUCTION MANAGER (CM)

CONTRACTORS

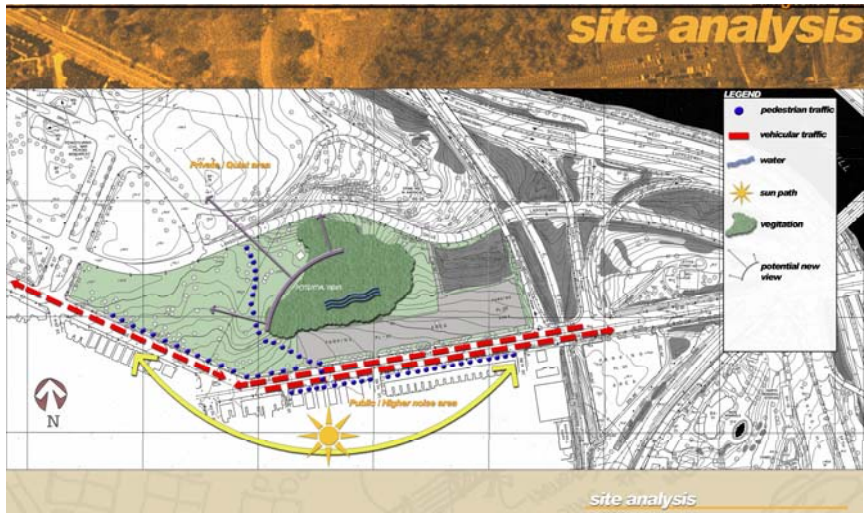
Holistic Design Process



- Holistic design
  - *Team effort* ensures all building components function most efficiently by working as a system.
  - *Establish goals* and track through design and construction process.
  - *Communicate and Involve* all stake holders are involved in the design process to reach a consensus design that is healthy, profitable, and resource efficient.
  - *Balance* program needs, budget, schedule, operation & maintenance, and aesthetics with environmental goals.

High Performance Design *Principles*

- Sustainable Site Design
  - *Protect* natural amenities
  - *Restore* the ecosystem whenever possible
  - *Respect* natural site features and orient the building to take advantage of wind, solar/sun, trees, views
  - *Improper Orientation or exposure can increase heating, ventilation, and AC costs by 30%*



Design Strategies to Consider:

North/South Orientation

Redevelop areas

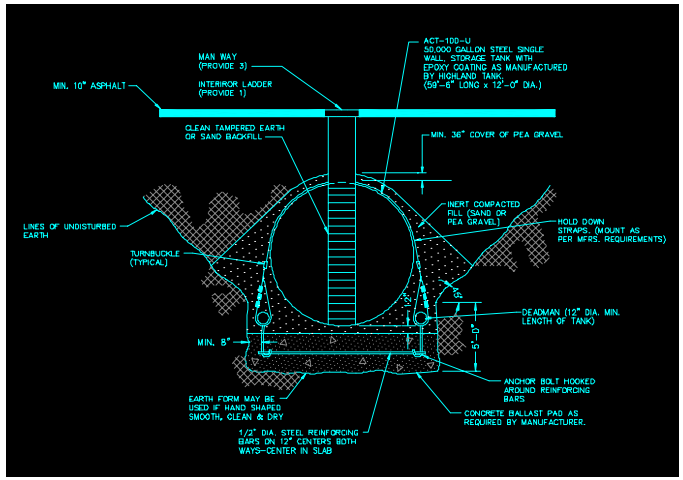
Pedestrian friendly design

Energy Star roof & Shading

Proper exterior lighting design

High Performance Design *Principles*

- Water Efficiency
  - *Reduce* drain on our water supply by using high efficiency or no-flush fixtures
  - *Reuse* natural resources such as rain water for irrigation and flushing instead of drinking water.
  - *Eliminate* or reduce contaminant run-off from the site through proper treatment such as constructed wetlands or filtering.
  - *Recharge* aquafers with permeable pavement



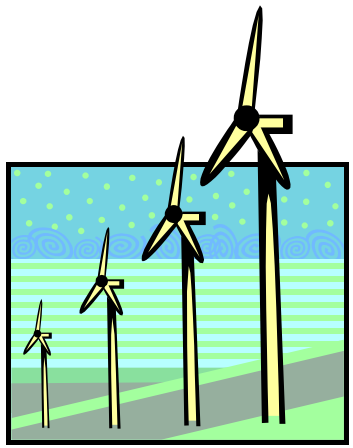
Rainwater Catchment System

Waterless Urinal

"Living Machine" water purification system

High Performance Design *Principles*

- Energy & Atmosphere Conservation
  - *Reuse* Solar, Wind, & Biomass Reduces reliance on fossil fuels
  - *Eliminate* HCFC's & CFC from Heating & Air Conditioning Systems.
  - *Reduce* energy consumption & operating costs by using efficient lighting & 'right size' HVAC design in combination with sensors natural lighting & & efficient building envelope. *Up to 50-90% reduced energy use can be obtained.*
  - *Lighting accounts for 30% & HVAC for approx. 60% of energy use.*



Wind

Solar Power

Thermal Storage (Ice for AC)

Energy Modeling

TABLE 2 - ELEMENTARY SCHOOL 1 SUMMARY OF RESULTS

Alternate	A1a (RDD)	A2a (VAV Water Chiller)	A2b (Co2 only)	A3a (VAV Air Chiller)	A3b (Co2 only)	A4c (GSHP)
Lighting	199268	199268	199268	199268	199268	199268
Other	59950	59950	59950	59950	59950	59950
Subtotal	259218	259218	259218	259218	259218	259218
Building Area	70000	70000	70000	70000	70000	70000
BTU/SF/YR	12642	12642	12642	12642	12642	12642
Electric Demand	188	220	264	299	356	282
Electric Use	348512	390055	481737	423637	526297	799264
Electricity Costs	$ 47,252	$52,879	$ 64,122	$ 61,841	$ 75,104	$ 97,224
Natural Gas Use	11571	16225	27251	16225	27251	4314
Natural Gas Cost	$ 10,414	$ 15,479	$25,998	$15,479	$25,998	$4,115
Total Costs	$ 57,666	$ 68,358	$90,120	$ 77,320	$101,102	$101,339
Total Energy Use BTU/SF/YR	33522	42197	62418	43834	64591	45133
Net HVAC Loads BTU/SF/YR	20880	29554	49776	31191	51948	32490
HVAC Load (% Total Load)	62%	70%	80%	71%	80%	72%
HVAC Load (% Base Alt.)	**100%**	**142%**	**238%**	**149%**	**249%**	**156%**
Annual Savings Vs. Base System	**$0**	**-$10,692**	**-$32,454**	**-$19,654**	**-$43,436**	**-$43,673**

Photovoltaic Payback Study

•100kw Photovoltaic Gross Price (incl. Tax):	$722,855	100%
•EDA Section 15 Grant:	$(289,149)	-40%
Subtotal	$(433,706)	60%
•NJ Clean Energy Program Grant:	$(206,224)	-60 of 60%
•*Price Less Incentives:*	$ 227,482	25%+

Revenues (25 year totals**):**

	Total
Avoided electricity cost	**495,808**
Peak load savings	**202,313**
HVAC savings	**36,310**
Re-roofing Savings	**72,620**
Green attributes value	**142,273**
Electrical loss savings	**14,874**
Total Revenue:	**964,197**

THIS MEANS THAT THE RETURN ON INVESTMENT WILL BE $38,568/yr AVERAGE OR A 5.8 YEAR PAYBACK!

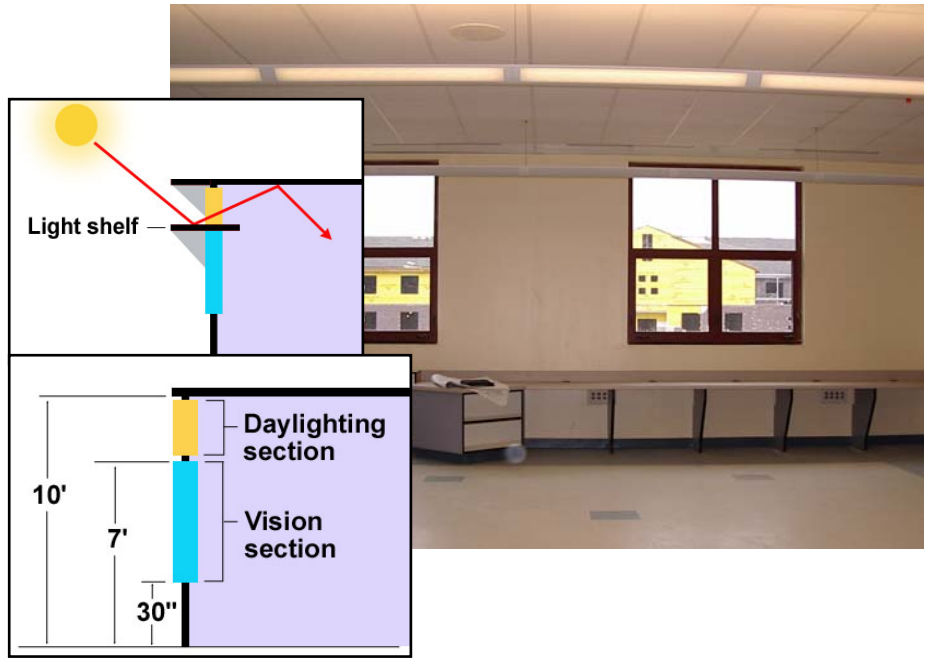
High Performance Design *Principles*

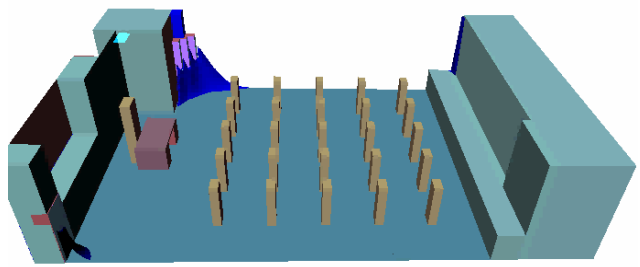
- Material & Resource Conservation
  - *Local* materials
  - *Recycled content* (Steel, Masonry, carpet, ceiling tile, gypsum, windows)
  - *Sustainably harvested* (FSC wood, bamboo, linoleum)
  - *Recycle construction waste* (75% min.)
  - *Durable* materials that perform well acoustically and not maintenance intensive

SOURCING: www.buildinggreen.com

High Performance Design *Principles*

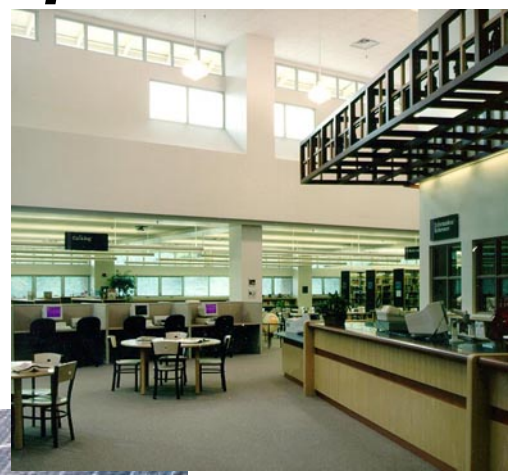
- Indoor Environmental Quality
  - *Acoustic Comfort* (SIL of 35dba or less in space per ANSI)
  - *Remove Toxins* (formaldehyde, VOC's, and Chlorine found in many typical building products which off gas at room temperature)
  - *Ventilation Effectiveness* by providing adequate HVAC with 100% outside air, proper filtration, & displacement delivery
  - *Adequate Daylighting* and control (light shelves, skylights, solar tubes, photo sensors)
  - *Thermal Comfort* by providing sufficient opportunity for users to regulate the temperature with localized controls integrated with sensors





High Performance Design *Principles*

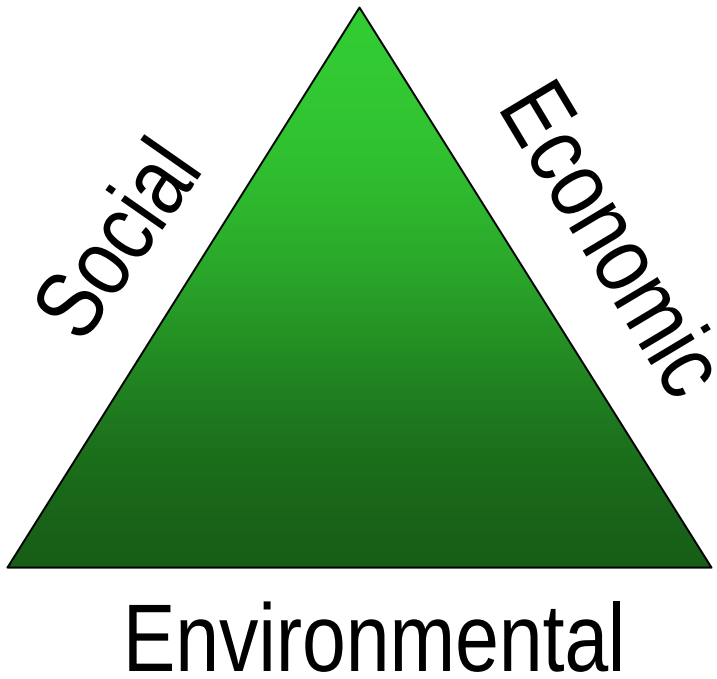
- Education & Community
  - The building is a *teaching tool*.
  - *Adaptive, Relevant, Continuous* Accessible to the community, represent the community in form and flexibility, and which instill a sense of pride are building which will be well maintained, well received, and well utilized for generations.
  - *Conserve tax dollars* on O&M while providing healthier, more productive environment for all to enjoy.



High Performance Design *Principles*

- Fundamental Systems Commissioning:
  - *Third Party Verification* of HVAC design & Installation ensures design team & Owner that system is installed & performing as intended. Similar to performance specifications, but requires independent third party verification.
  - *Code Requirement.* Adoption of ASHREA 90.1, 1999 requires systems commissioning for building >50,000sf
  - *Integration* of systems (I.e. lighting & HVAC with occupancy sensors & DDC controls optimizes system performance by assuring correct interaction of components.)

Importance of High Performance Design

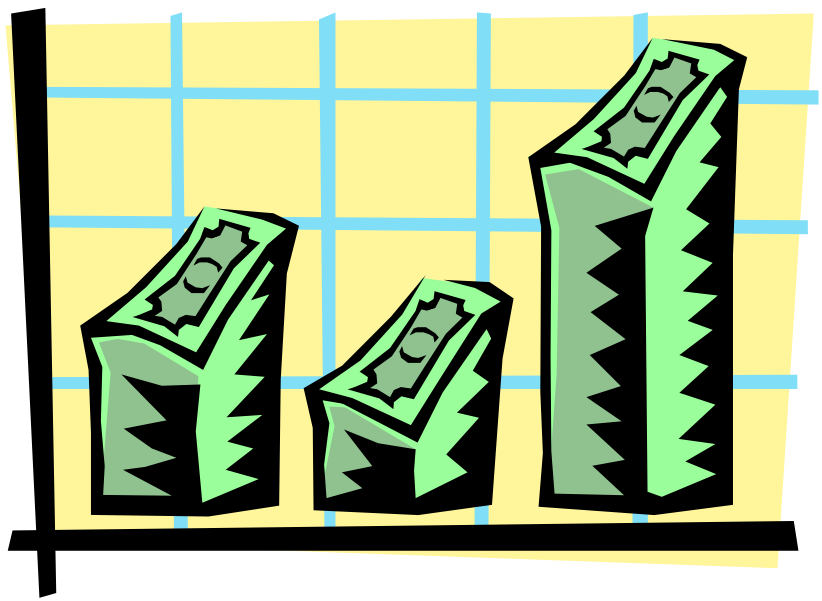


Importance of High Performance Design

- *SOCIAL:*
  - *Improve* Student Performance (Heschong Mahone daylighting study shows 20-26% better test scores)
  - *Reduce* Liability due to Sick Bldg. Syndrome
  - *Increase* Daily Attendance and Employee Retention

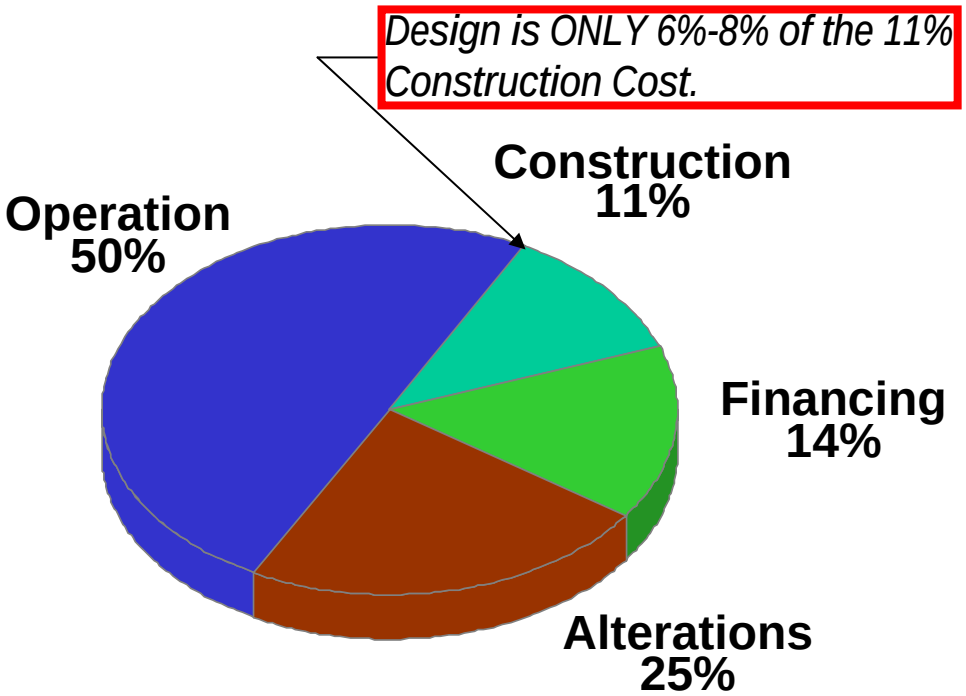
Importance of High Performance Design

- *Economic*
  - ➢ *Reduce* Operating Costs by increasing performance of HVAC and lighting
  - ➢ *Reduce* Maintenance Costs
  - ➢ *Increase* Reliability & Durability
  - ➢ NO ADDITIONAL FIRST COST MAY BE NEEDED



Life Cycle Cost vs First Cost

- All of the decisions affecting this entire life cycle cost are made in the smallest portion of the building life cycle cost- Design.
- High Performance Design must be incorporated from the start!



Importance of High Performance Design

- *Environmental: resources are limited……*

➢65.2% of total U.S. electricity consumption

➢12% of potable water in US consumed by buildings

➢30% of total U.S. greenhouse gas emissions

  ➢Atmospheric emissions from the use of energy lead to acid rain, ground-level ozone, smog, and global climate change.

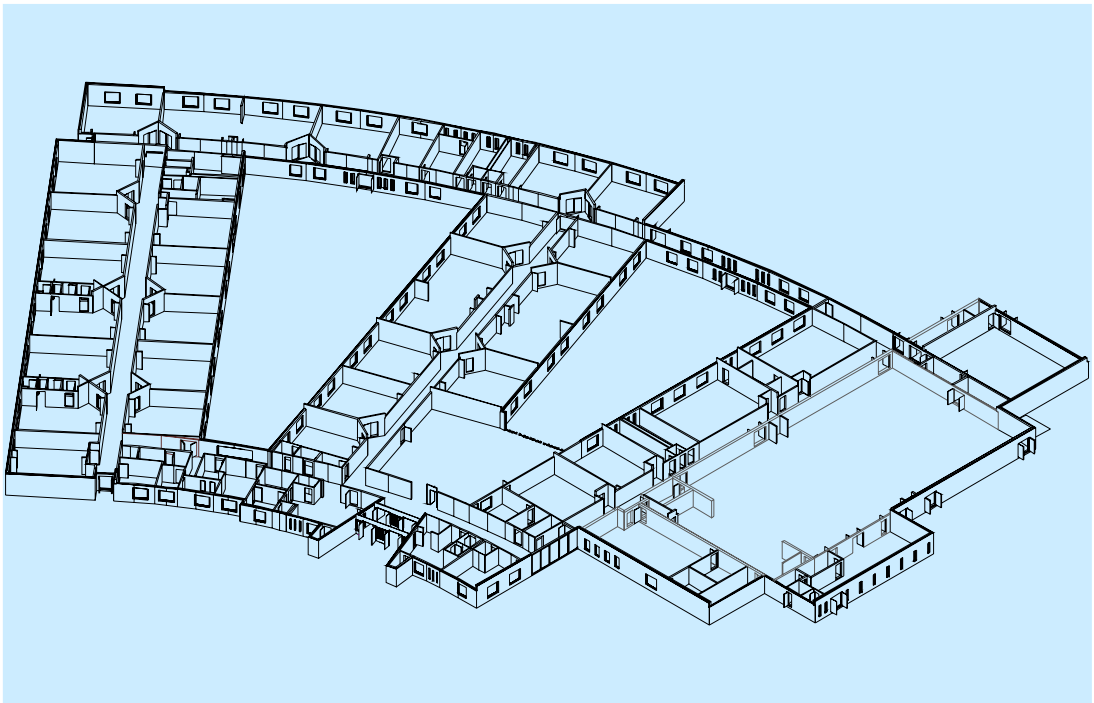
➢136 million tons of construction and demolition waste in the U.S.

  ➢Approx. 2.8 lbs per person per day

➢40% (3 billion tons annually) of raw materials used by buildings

Practical Applications:

Howell Elementary Schools

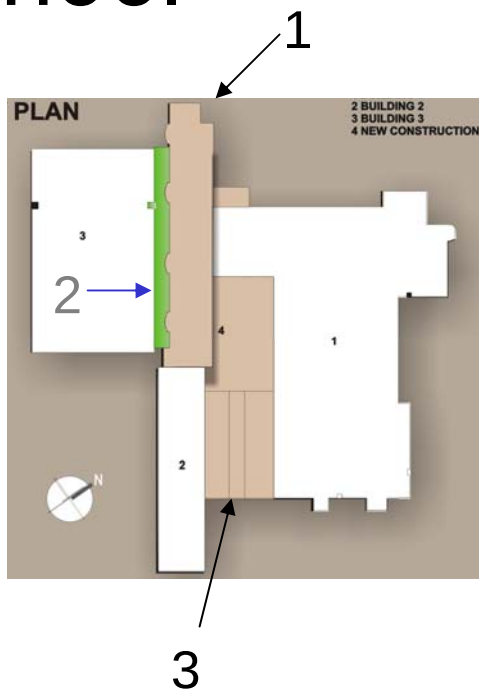


Typical Plan 3D Wire Frame

- Two new K-5, 70,000sf elementary schools for 500 students.
- Completion Date:
  - Sept. 2003
- Budget
  - $138/s.f.
- Actual Cost
  - $131/s.f.
- Designed to LEED Silver Certification.

Morris County Technical School

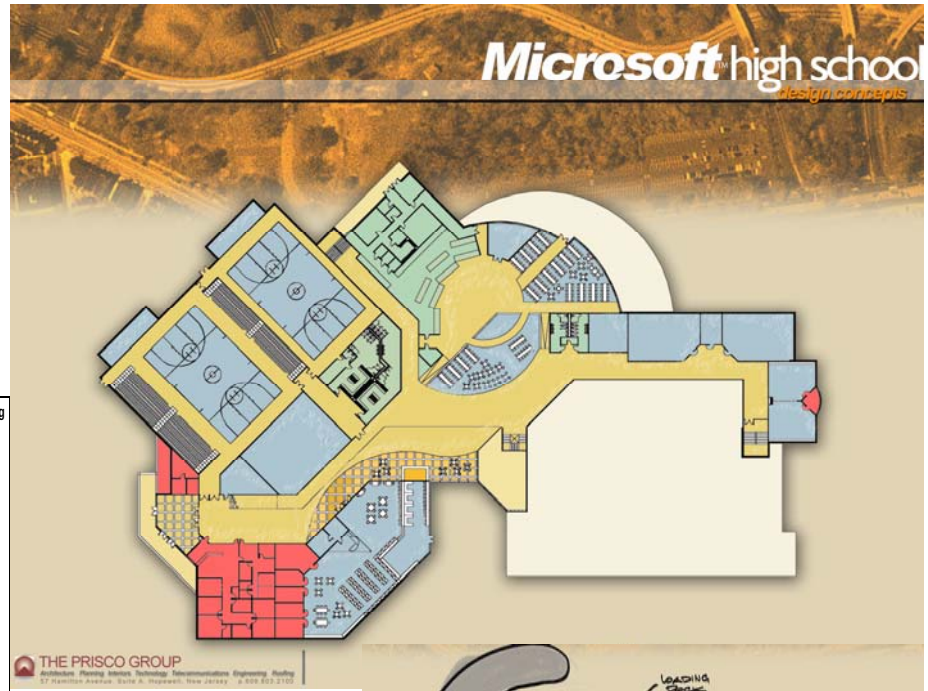
1. Route 53 Perspective

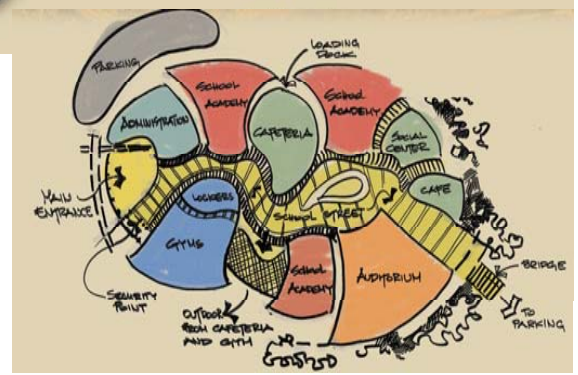


- Renovation of existing 50,000 s.f. in 4 buildings and 32,000 square foot in fill addition to house 16 classrooms, gym, media center, 2 large lecture halls, and support area
- Designed to meet LEED SILVER ON TIME AND ON BUDGET
- Cost: Ren.- $165/s.f.; Addition- $140/s.f. to completed 4/05

School of the Future

- *Designed to meet LEED GOLD*
- *Budget $230/sf, Complete 09/06*
- *160,000 sf for 800 students*
- *PV, Rainwater system, Green Roof, Waste Mngmt., Local/NonToxic Matl., High Efficiency HVAC, Daylighting, Controls, Park setting*





LEED Checklist and Implementation Strategy Plan

Submit for Credit				Strategy to Achieve/Outstanding Issues	Status	Who's Working On It
5						
	Prereq 1	**Erosion & Sedimentation Control**	0			
N	Credit 1	**Site Selection**	1			
N	Credit 2	**Urban Redevelopment**	1			
N	Credit 3	**Brownfield Redevelopment**	1			
Y	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1	Children bused to school	Done	**Rogaski**
M	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1	Verify Inclusion of Bike Racks on Site	In Progress	**Rogaski**
N	Credit 4.3	**Alternative Transportation**, Alternative Fuel Refueling Stations	1			
Y	Credit 4.4	**Alternative Transportation**, Parking Capacity	1	Do not exceed minimum local zoning req.	In Progress	**Civil/Kliwinski**
N	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1			
M	Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1	Reduce Building Footprint 25% below zoning	In Progress	**Civil/Kliwinski**
Y	Credit 6.1	**Stormwater Management**, Rate and Quantity	1	Design Zero Outflow System	In Progress	**Civil/Kliwinski**
M	Credit 6.2	**Stormwater Management**, Treatment	1	Remove 80% of TSS & 40% of TP	In Progress	**Civil/Kliwinski**
N	Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof	1	Strategy Not Approved by Owner		
Y	Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof	1	Design/Specify Energy Star Roof	Shop Drawings	**Trumbo**
Y	Credit 8	**Light Pollution Reduction**	1	Design Zero Light Spill Site Plan	Shop Drawings	**Ammons**
5 to 8						
2						
Y	Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1	No Irrigation System	Done	**Kliwinski**
Y	Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1	No Irrigation System	Done	**Kliwinski**
N	Credit 2	**Innovative Wastewater Technologies**	1			
M	Credit 3.1	**Water Use Reduction**, 20% Reduction	1	Verify Water reduction with "hands free"	In Progress	**Lentz/Kliwinski**
N	Credit 3.2	**Water Use Reduction**, 30% Reduction	1	Strategy Not Approved by Owner		
2 to 3						

Considerations in High Performance Design

- Consider initial cost VS Life Cycle Costing
- Fast Track process may not allow for design alternate considerations
- Owner and CM education factor in acceptance of ideas and principles
- Include in beginning of planning process before Floor Plan & Site plan fixed and changes not optional
- Equity in facilities and maintenance & operation methods among buildings may affect decisions
- Compromise to find ‘sweet spot’..balance budget, needs, and schedule

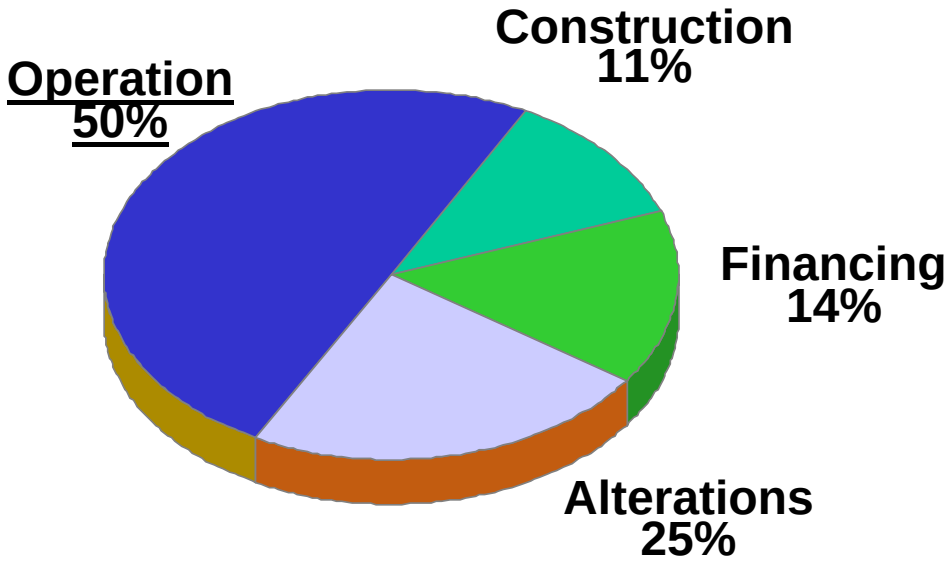
Costs of High Performance w/ LEED:

- LEED Registration $0* (Typically $350.00)
- Systems Commissioning $0* (Typically 1-2% HVAC Construction Cost Part of PSIT Scope of Work)
- LEED Design/Documenting $0** (Not Established, but can be 1-2%overall fee increase)
- LEED Certification $0* (Typically $1,200)

* Rebates, grants and/or Incentives can completely offset the cost of LEED registration, certification, & commissioning.

** Documentation required for LEED is consistent with normal project construction documents and shop drawing/project submittals. NO ADDITIONAL FEE SHOULD BE ASSOCIATED WITH THIS!!!

Questions?



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